of the parameters and measurements of the system he sets in motion and draw tentatively the fleeting evidence from it. The theoretician is a synthesizer, evidence comes to him with a certainty that, though Heisenbergian, is only limited by the dimensions and forms of the universe within which he is working. Euclid is right on his two to three dimensions as Einstein is on four or five, and so on. The Euclidean view was necessary but not sufficient. Where Euclid felt secure in the simple beauty and *superficial* logic of planar geometry, Einstein foresaw the limitations of even his generalized relativity and searched continuously for further unification.

A distinction must be made between unproved experimental observation, often erroneously called theory, and *theoria vera,* the result of veridical and integral observations by the mind. The example given of Medawar and Burnet illustrates the many that could be quoted of advances in biology and medicine by experimenting in the mind. Tyler, for instance, predicted that backgrafted F_1 hybrids would develop lymphomas. As basic data of first order become available from partial and limited syntheses of function-structure phenomenology, the minds of the real theoreticians will transduce and translate them into higher, and yet simpler, forms of synthesis-comprehending.

There is no precision and exactness in scientific evidence. Its median, focal, photographic clarity, like the insisting thematic leitmotiv of a Beethoven symphony or the immediacy of a Flemish portrait, are no more true (or more beautiful) than the indistinctness of impressionistic painting and music and even distorting and less tonal followers. All are part of a Poisson curve, a Dalton-Gaussian distribution, nature's trials and errors, a quantum, discontinued nature, all wave-matter, time-space. Only the human mind is able to integrate it into abstract thought of continuity. The experimental observations close in a polyhedron whereas the theoretical thought finishes it to a sphere.

In medicine, with its inherent pragmatism, we go by what works, what time tests and sanctions, what gets wide acceptance, what is well remembered and even fashionable. In narrower circles one even speaks of standards of community practice. PDBRS are relatively recent and exist only for a very limited number of concepts, procedures and medications. Medicine cannot stop to take a total PDBRS inventory of its knowledge stock. Such inventory would be irrelevant because the precision of its discoveries lies not in whether they are PDBRS-proof but in the concatenation of factual data, that is, in their cross-veracity. This cross-veracity is what appears as a sudden, thrilling, illuminating evidence and inner, unconfessed, certainty to its discoverer and less, sometimes never, to its critics (even the constructive ones), until it is *released* once again in another equaled mind.

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A Technique to Prevent Headaches After Diagnostic Lumbar Puncture

TO THE EDITOR: Lumbar punctures for diagnostic examination of cerebrospinal fluid (CSF) have been carried out since the turn of the century and have frequently been accompanied by post-lumbar-puncture headaches (PLPH).[1]

Tourtellotte[2] has reported in his summary of 21,000 standard lumbar punctures that the incidence of PLPH is 32 percent for diagnostic lumbar punctures, 18 percent for obstetrical spinal anesthesia and 13 percent for nonobstetrical anesthesia. The typical PLPH[2] starts about 10 hours after the lumbar puncture with a backache, followed within 14 hours by a postdural headache. The range of onset is from 15 minutes to four days after the procedure. It persists for 2 to 14 days (average 3 days) and is characterized by a retro-orbital frontal aching and pounding. Occasionally, it is accompanied by nausea and vertigo. Immediate relief usually occurs when the person lies down. Few people are able to carry out normal activities with such a headache and analgesics are of little use. The most effective treatment is the epidural blood patch recently reviewed in this journal by Brodsky.[3] Of 570 patients with PLPH, 95 percent had relief after this procedure. Many patients are subjected to risk of PLPH, since more than 800,000 lumbar puncture trays are used each year in nonfederal and non-state-operated hospitals (unpublished data provided by IMS-America, Ambler, Pennsylvania 19002, 1978).

Although the PLPH can be effectively treated, it is preferable to prevent them from occurring. In most instances this can be done by using a thinner needle than is standard. The single factor that contributes most to the development of PLPH is the diameter of the hole made in the dura by the needle.[2,4] The use of the prone position for 1 to 24 hours following the procedure to prevent

PLPH is standard practice, although its utility is open to question and is inconvenient for outpatients. A small needle for lumbar puncture was discussed by Hoyt in 1922,[5] but has been mentioned only a few times in the literature.[2,6,7] Standard diagnostic lumbar puncture trays utilize 18- to 22-gauge needles, making it inconvenient to carry out the procedure with thinner needles.

Chemical analysis of cerebrospinal fluid may have increasing use for assessment of cerebrospinal fluid chemicals and their relationship to a number of neuropsychiatric disorders. The use of small needles to obtain specimens of fluid for chemical assay is warranted when cerebrospinal fluid pressure is not needed; small needles cannot accurately be used to assess pressure.

The present successful technique to minimize PLPH has been adapted from Green[6] and has been found to be easy to do and is adaptable to current disposable trays. The patient is placed in the usual lateral decubitus position. A local anesthetic is injected at the third or four lumbar space to a depth of 1 to 1.5 cm. A 1½ inch, 20-gauge needle is then placed into the skin and directed as if it were a lumbar puncture needle (that is, aimed toward the umbilicus). It is inserted 1½ inches in large persons and 1 inch in thin persons. This needle is necessary since the thin spinal needles will not easily penetrate skin. A 25- or 26-gauge spinal needle is then inserted bevel up through the intradermal needle and through the dura. Inserting the needle bevel up minimizes the number of longitudinal dural fibers that are cut. A *pop* may or may not be felt as the dura is penetrated. When the stylet is removed, cerebrospinal fluid will appear within five to ten seconds. The fluid will flow slowly under normal pressure and therefore a small length of the plastic tubing that comes in the tray is attached to the needle hub, a syringe is attached to the free end of the tube and fluid is slowly withdrawn at a rate of not greater than 1 ml per minute. More rapid withdrawal may produce a headache like that of PLPH. Between 20 and 30 ml of fluid may be obtained without difficulty in this manner. After sufficient cerebrospinal fluid has been obtained, the inner and then the outer needles are withdrawn and patients then roll to the prone position for one hour. They then can carry out normal, nonstrenuous daily activities. An hour of bedrest is not necessary and has been deleted without untoward sequelae in outpatient situations.

If the dura is not apparently entered, the inner needle must be withdrawn before repositioning the outer needle which should be partially or completely withdrawn and redirected and the attempt repeated. If this fails repeatedly at more than one interspace after the patient has been *carefully* and *symmetrically* positioned, a larger single spinal needle may be used successfully. In our hands, this is necessary less than 5 percent of the time and constitutes the only drawback of the procedure.

We have recently carried out lumbar punctures for diagnostic and research purposes in 36 normal persons and 60 inpatients with psychiatric disorders. Ages ranged from 17 to 69 years old. In 15 of the normal persons probenecid lumbar puncture was also done.[8] Written informed consent was obtained from each subject. All lumbar punctures were done with the described technique and were atraumatic. Patients were followed by telephone or by personal interview over the ensuing week to determine the occurrence of PLPH. No PLPH occurred after any of the 96 initial procedures. One would have anticipated between 20 to 30 of these would have been followed by PLPH. In four of the normal persons PLPH developed within eight hours after a probenecid lumbar puncture, done 40 hours after the first procedure. Two of these subjects had engaged in strenuous physical activity following the lumbar puncture and associated this with the onset of the PLPH. The increased incidence following these PLPH's may have been due to the presence of a second hole in the dura.

In settings where cerebrospinal fluid is needed for chemical or hematological analysis, anesthesia or outpatient use, use of a small needle may be a preferable technique due to the decreased incidence of PLPH.

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